

Logic Families

- Improved TTL series :

* 74H XX (high speed TTL) :

- reduce the internal resistor.
- increase consumption.
- Propagation delay = $\frac{1}{2} t_P$ for fundamental.

* 74L XX (Low Power TTL) :

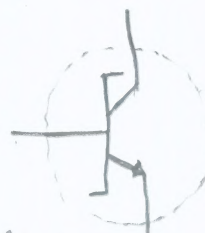
- increase internal resistor
- Decrease consumption

- Schotky TTL : (74S XX)

ON \rightarrow 0.3V

Equivalent circuit \Rightarrow schotky transistor

* 74LS XX (Low Power schotky TTL)

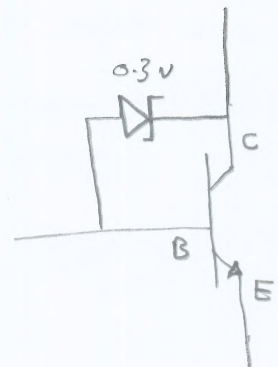


Schotky transistor

* 74ALS XX (Advanced Low Power schotky TTL) :

propagation delay = 4 ns

Power dissipation = 1 mW

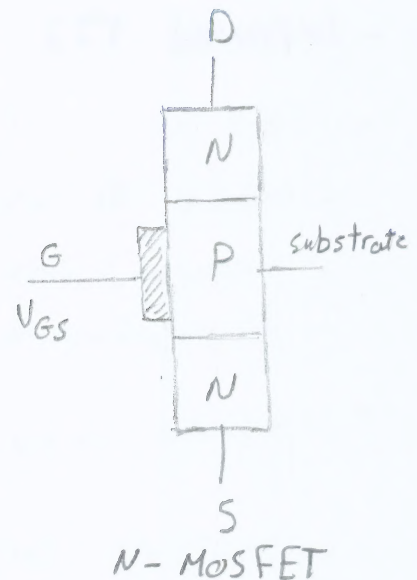


CMOS family : (Complementary Metal oxide semiconductor)

MOSFET $\begin{cases} \text{N-MOSFET} \\ \text{P-MOSFET} \end{cases} \Rightarrow \begin{matrix} \text{LSI} \\ \text{VLSI} \end{matrix}$

$\begin{cases} V_{GS} > 0 \Rightarrow \text{ON} \\ V_{GS} \leq 0 \Rightarrow \text{off} \end{cases} \quad (\text{N-MOSFET})$

$\begin{cases} V_{GS} \leq 0 \Rightarrow \text{ON} \\ V_{GS} > 0 \Rightarrow \text{off} \end{cases} \quad (\text{P-MOSFET})$



CMOS : ($V_{DD} \rightarrow 3\text{V} : 15\text{V}$)

$V_{in} \rightarrow \text{Logic 1}$

N-MOSFET $\rightarrow \text{ON}$

P- " " $\rightarrow \text{off}$

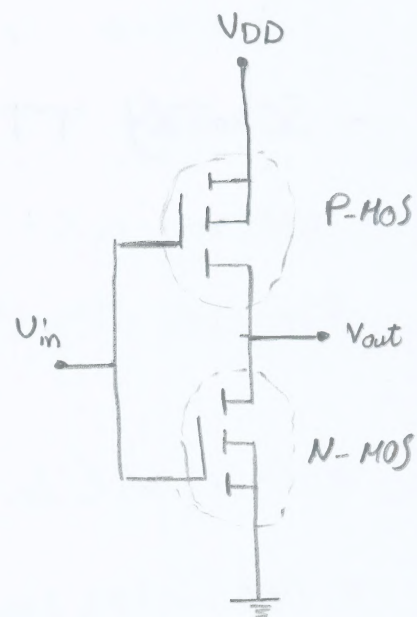
$V_{out} \rightarrow \text{Logic 0}$

$V_{in} \rightarrow \text{Logic 0}$

P-MOSFET $\rightarrow \text{ON}$

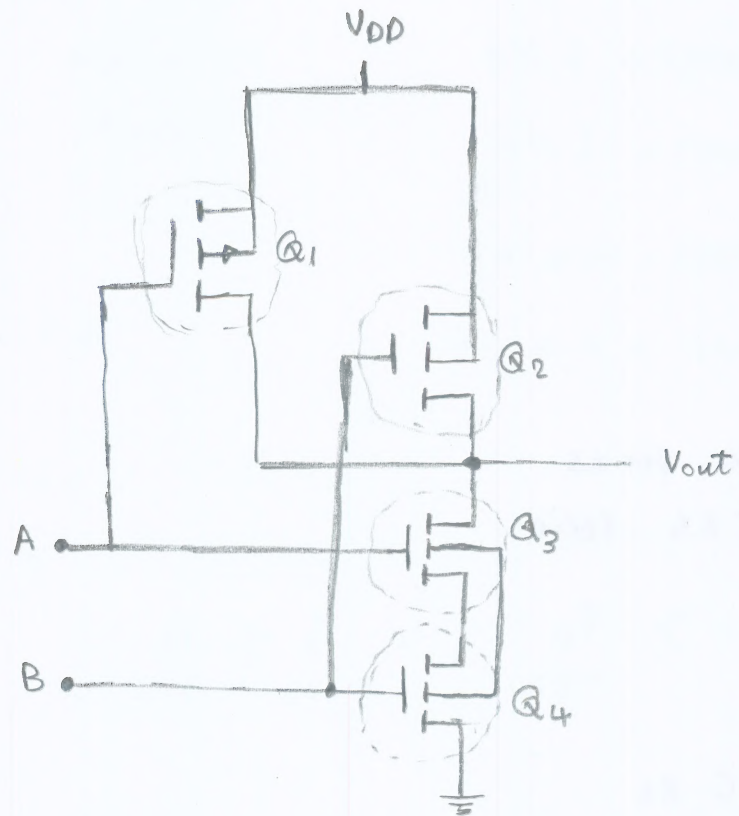
N- " " $\rightarrow \text{off}$

$V_{out} \rightarrow V_{DD}$



CMOS - NAND gate :

* operation Report



Voltage & Current rating :

$$I_{IH} (\text{max}) = 1 \text{ mA}$$

$$I_{IL} (\text{max}) = 1 \text{ mA}$$

$$I_{OH} (\text{max}) = 0.4 \text{ mA}$$

$$I_{OL} (\text{max}) = 0.4 \text{ mA}$$

* 4000 Series

* 74CXX Series

$$t_D \text{ C-MOS} > t_D \text{ TTL}, \quad P_D \text{ C-MOS} < P_D \text{ TTL}$$

* 74LCXX

* 74-Bi-CMOS (TTL - CMOS) $t_P \rightarrow 2.9 \text{ nsec}$

* 74HCXX / 74HCTXX (High Speed / High speed compatible with TTL)

* 74VHCXX / 74VHCTXX

* 74-Low Voltage Series (Power supply $\leq 3.3 \text{ V}$)

for notebook & mobile phones

- 74LVC (Low voltage CMOS)

- 74LVT (Low Voltage Technology)

74HLV (High Speed - Low voltage)

